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McGinnis

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[54] **ANTENNA SUPPORT SYSTEM**

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[51] **Int. Cl.**[7] **H01Q 1/12**

[52] **U.S. Cl.** **343/890**; 343/771; 343/891

[58] **Field of Search** 343/771, 890, 343/891, 892; H01Q 1/12

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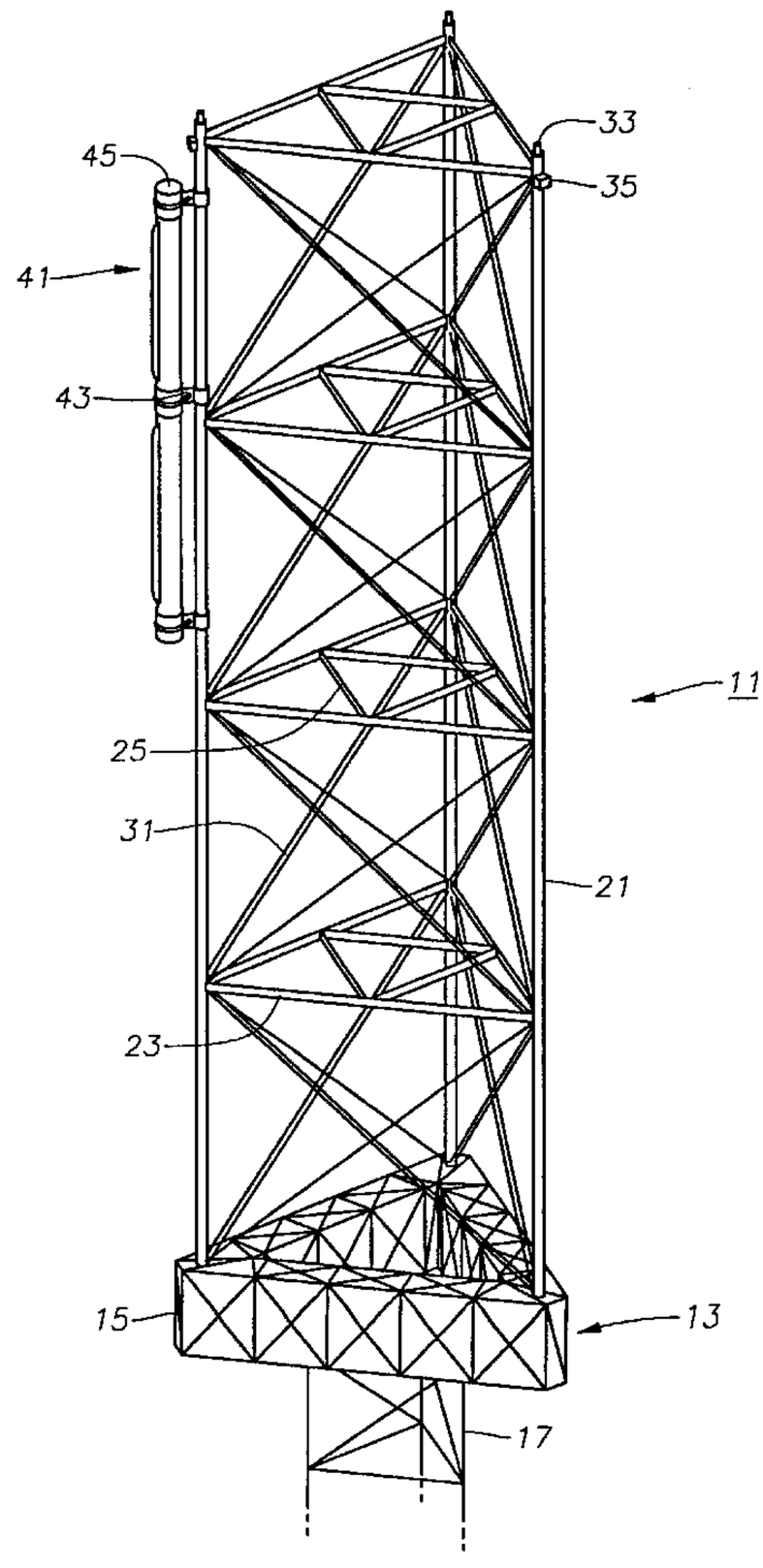
[57] **ABSTRACT**

An antenna support for a communications tower has three or more vertical steel legs which are joined along their lengths by nonmetallic lattice members. The lattice members include horizontal braces and diagonal nonmetallic wires. At least one digital or analog antenna is mounted to one or more legs of the antenna support. Alternatively, each leg may function as an antenna and contain a number of wave guides. The legs are cylindrical and slots are milled in each leg for enhancing the performance of the wave guides. The total number of slots and their spacing may vary as a function of the frequency and pattern direction of the wave guides.

15 Claims, 3 Drawing Sheets



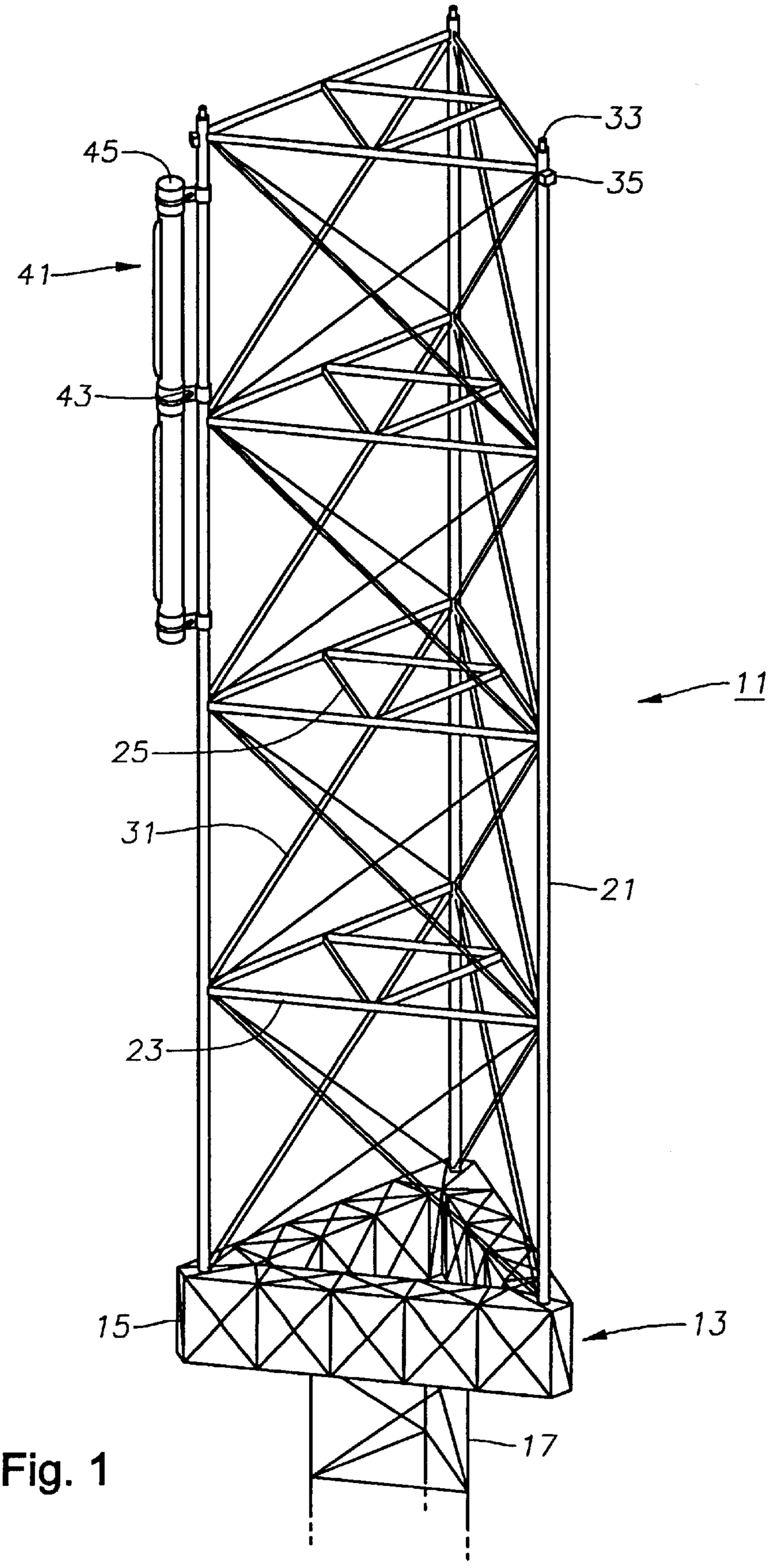


Fig. 1

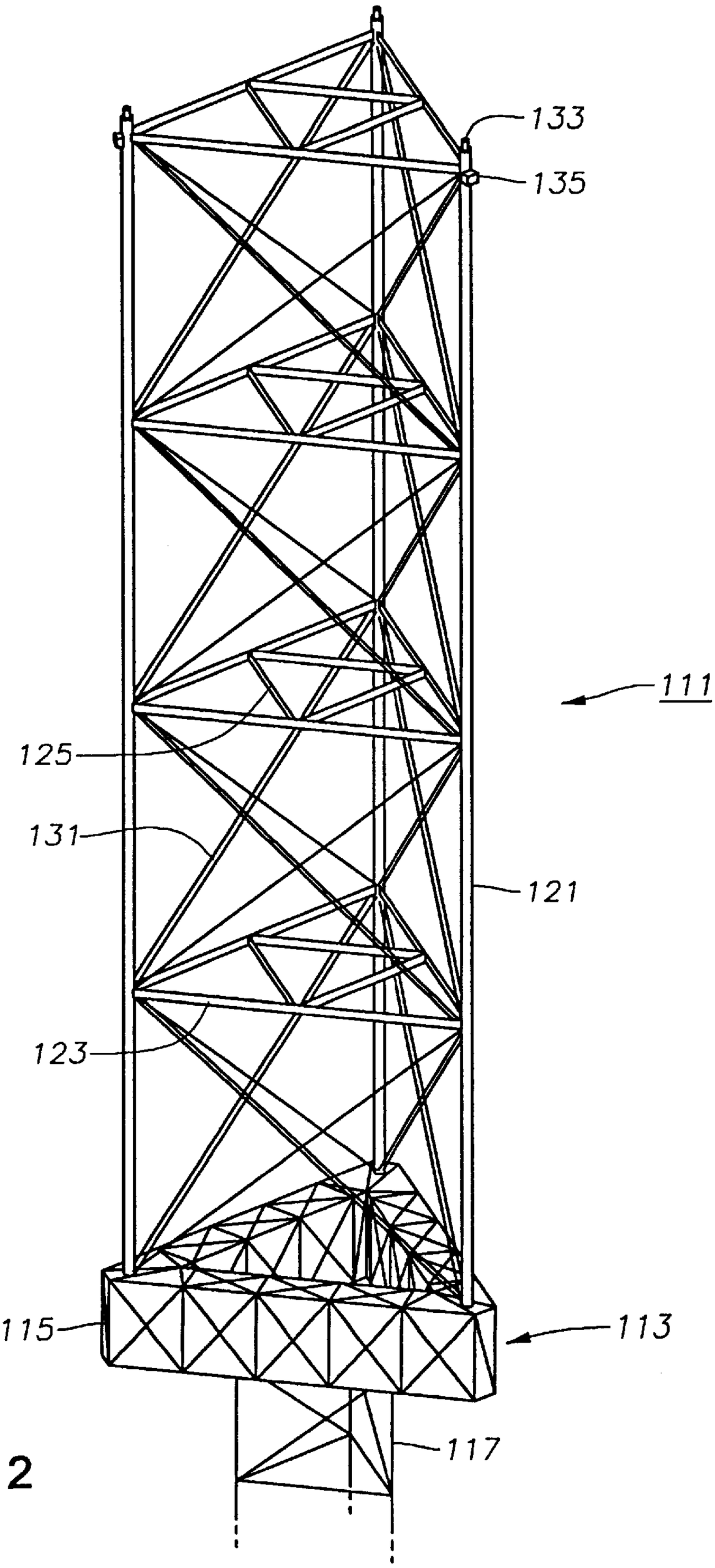


Fig. 2

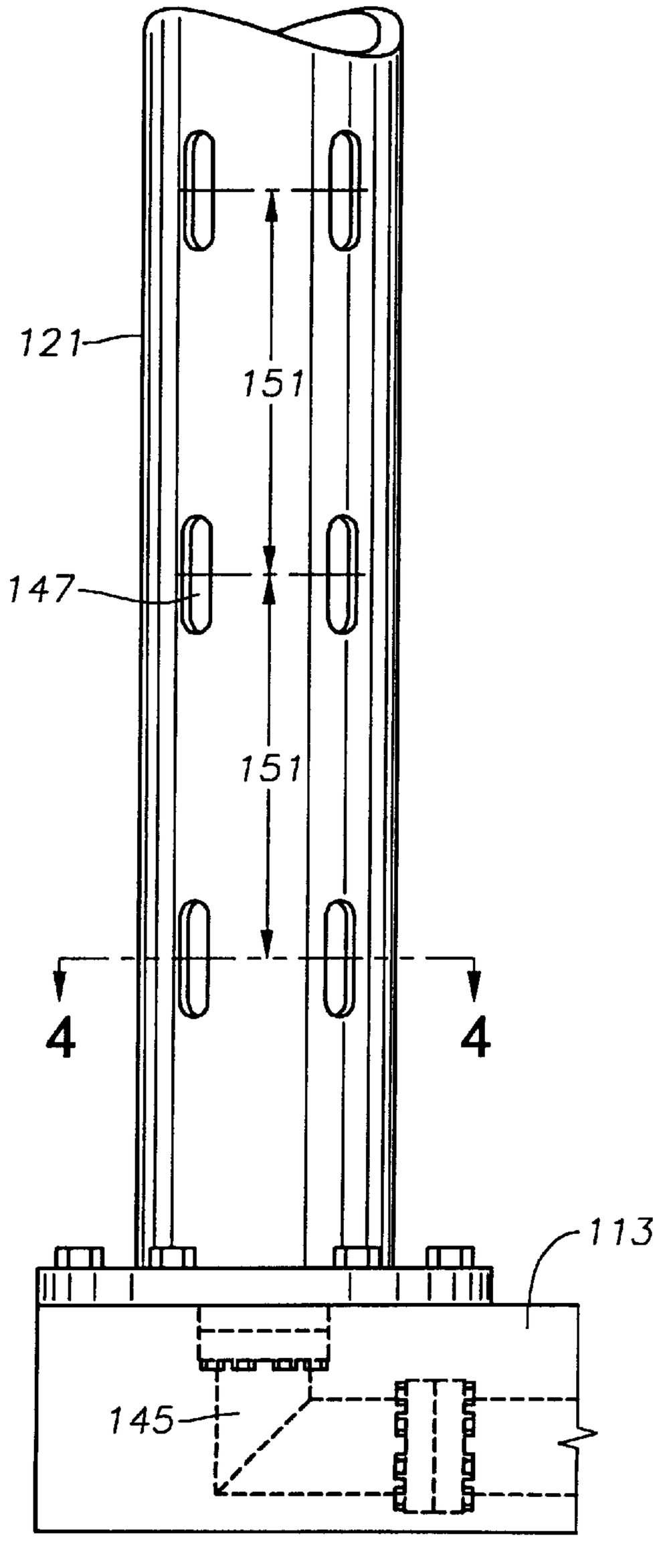
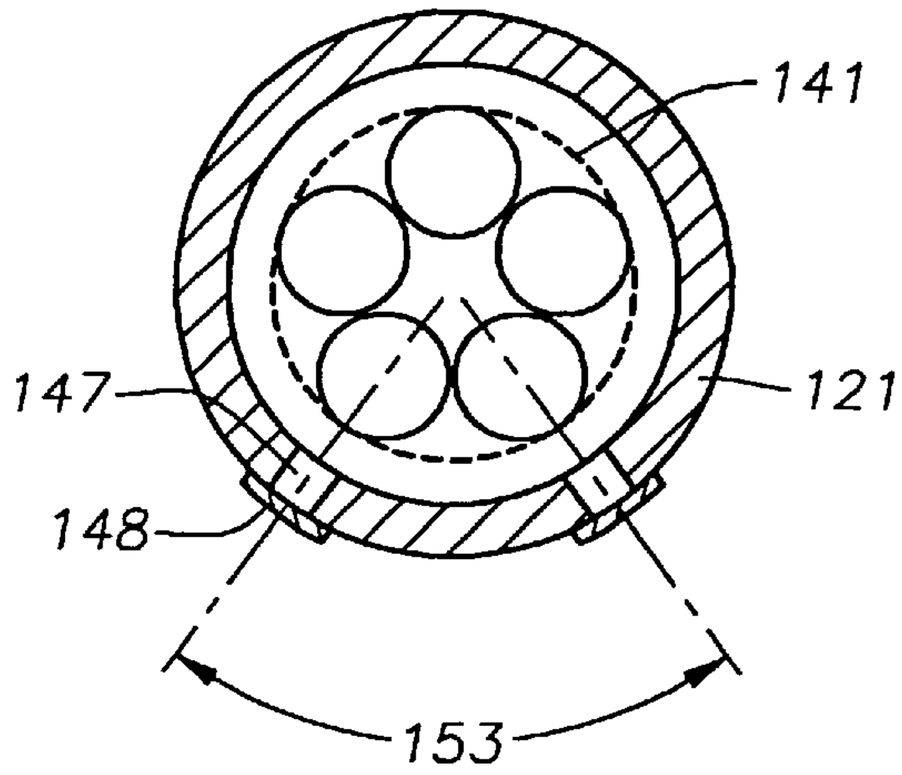


Fig. 3

Fig. 4



ANTENNA SUPPORT SYSTEM

TECHNICAL FIELD

This invention relates in general to communications towers and in particular to a digital or analog antenna support.

BACKGROUND OF THE INVENTION

Antenna supports are typically used to mount digital and/or analog antennas to communications towers. In the prior art, antenna supports are typically formed from steel trusses, pipes and guy supports. These steel members can detrimentally affect the signals received and transmitted from the individual antennas. In some areas, such as residential or high visibility areas, communication tower antenna supports which are less conspicuous or which have a slender profile are desirable. An antenna support which incorporates one or both of these features is needed.

SUMMARY OF THE INVENTION

An antenna support for a communications tower has three or more vertical steel legs which are joined along their lengths by nonmetallic lattice members. The lattice members include horizontal braces and diagonal nonmetallic wires. At least one digital or analog antenna is mounted to one or more legs of the antenna support. Alternatively, each leg may function as an antenna and contain a number of wave guides. The legs are cylindrical and slots are milled in each leg for enhancing the performance of the wave guides. The total number of slots and their spacing may vary as a function of the frequency and pattern direction of the wave guides.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is an isometric view of an antenna support structure mounted to the top of a conventional communications tower and is constructed in accordance with the invention.

FIG. **2** is an isometric view of a second embodiment of the antenna support structure of FIG. **1**.

FIG. **3** is a partial enlarged side view of one pipe of the antenna support structure of FIG. **2**.

FIG. **4** is a sectional end view of the pipe of FIG. **3** taken along the line **4**—**4** of FIG. **3**.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring to FIG. **1**, an antenna support **11** is shown. Antenna support **11** may be provided with a steel truss **13** on its lower end. In the embodiment shown, truss **13** is generally triangular in shape and has a height of approximately ten feet, but the shape and height may vary. Truss **13** is parallel to the ground below and comprises a large number of interlocking braces or struts **15** for additional strength. Truss **13** is provided for mounting antenna support **11** to the upper end of a conventional communications tower **17**. Tower **17** extends upward from the ground and is typically supported by a plurality of guy wires (not shown). Tower **17** may be free standing as well.

Antenna support **11** comprises three or more cylindrical steel legs or pipes **21** which extend vertically upward from the triangular corners of truss **13**. Pipes **21** are parallel to one another. In one embodiment, each pipe **21** is approximately twelve inches in diameter and 130 feet long. Pipes **21** are interconnected by nonmetallic lattice members. The lattice members may be of various configurations, and include a plurality of horizontal, triangular braces or channels **23** located above and parallel to truss **13**. Channels **23** are also perpendicular to and join pipes **21**. Channels **23** are formed

in sets of three, defining a triangular configuration. Each end of each channel **23** is fastened to a pipe **21**. Channels **23** are symmetrically spaced apart relative to one another and are formed from a nonmetallic composite material such as fiberglass. The uppermost channel **23** may be formed from steel for additional strength. An inverted triangular support member **25**, made up of three braces, is located in the interior of the three braces comprising each channel **23**. Each corner of support member **25** is fastened to and bisects one of the horizontal braces of its respective channel **23**. In the preferred embodiment, support members **25** are also formed from a composite fiber material.

Antenna support **11** also comprises a plurality of diagonal guy supports **31**. Each guy support **31** comprises two parallel, nonmetallic composite fiber wires connected in tension. One guy support **31** extends diagonally between an end of each horizontal channel **23** to an opposite end of the horizontal brace **23** located above. Adjacent guy supports **31** cross each other in an "x" configuration, connecting the other ends of the horizontal braces **23**. Thus, two guy supports **31** extend between each horizontal brace **23** and the next one above. In addition, two guy supports **31** extend downward from each of the ends of the lowermost set of horizontal braces **23** to the opposing corners of truss **13** where they intersect legs **21**. A red beacon **33** and a strobe **35** are mounted to the upper end of each pipe **21** near the uppermost channel **23**.

Antenna support **11** is provided for mounting a plurality of conventional digital or analog antennas **41** (only one shown) along the outer edges of pipes **21**. Each antenna **41** has a nonmetallic body that is generally cylindrical in shape. At least two brackets **43** secure antenna **41** to one of pipes **21** on antenna support **11**. The body of each antenna **41** houses waveguides which are oriented to receive and/or transmit signals from directions away from antenna support **11**. Although the waveguides are not shown in FIG. **1**, they are further described in connection with the second embodiment. The wave guides are contained with a housing **45** which is a tubular member mounted parallel to leg **21**. In the preferred embodiment (not shown), antenna support **11** may support multiple antennas **41** on each pipe **21**. When properly installed, antennas **41** are vertically aligned and parallel to pipes **21**.

Referring to FIG. **2**, a second embodiment of the invention is shown. An antenna support **111** is provided with a steel truss **113** on its lower end. In the embodiment shown, truss **13** is generally triangular in shape and has a height of approximately ten feet, although the configuration and height may vary. Truss **13** is parallel to the ground below and comprises a large number of interlocking braces or struts **115** for additional strength. Truss **113** is provided for mounting antenna support **111** to the upper end of a conventional communications tower **117**. Tower **117** extends upward from the ground and is typically supported by a plurality of guy wires (not shown). Tower **117** may be free standing as well.

Antenna support **111** comprises a plurality of hollow, parallel legs or pipes **121** which extend vertically upward from the triangular corners of truss **113**. Pipes **121** may be formed from steel, aluminum or other nonconductive materials such as fiberglass. Pipes **121** are load supporting, and, in one embodiment, each pipe **121** is approximately twelve inches in diameter and 130 feet long.

Antenna support **121** also has a plurality of braces or channels **123**, support members **125**, and guy supports **131**. These components are identical to channels **23**, support members **125** and guy supports **131**, and are connected to pipes **121** in the same manner described above for legs **21**.

Referring now to FIGS. **3** and **4**, each pipe **121** functions as an antenna and contains a plurality of wave guides **141** therein. Each wave guide **141** is generally cylindrical in

shape and is bundled with other wave guides **141** inside pipe **121**. In the embodiment shown, antenna support **111** may support multiple antennas within each pipe **121**. When properly installed, portions of wave guides **141** are vertically aligned and parallel to pipes **121**. A conduit **145** at the lower end of each pipe **121** serves as a housing for a transmission line (not shown) and/or wave guide **141**. The transmission line extends between tower **117** and a transmitter (not shown).

A plurality of slots **147** are milled in each pipe **121** at precise intervals. Slots **147** are organized individually or in pairs and are provided for enhancing the performance of wave guides **141**. Pipes **121** and waves guides **141** are designed to get wave/signal fronts to each slot **147** at approximately the same time.

Each slot **147** is closed or sealed with a thin fiberglass or a similar nonmetallic seal **148** (FIG. **4**). Each pair of adjacent slots **147** is vertically spaced apart from one another by a precise dimension **151** (FIG. **3**). Dimension **151** and the total number of slots **147** may vary as a function of the frequency and pattern direction of wave guides **141**. Each pair of slots **147** is also offset from one another by a precise angular dimension **153** (FIG. **4**). Dimension **153** and the total number of slots **147** may vary as a function of the pattern direction of wave guides **141**. Thus, although in the embodiment shown pipe **121** has six slots **147**, pipe **121** could contain more or fewer slots **147** which are vertically and angularly spaced apart at greater or lesser dimensions.

The invention has several advantages. The antenna supports disclosed are strong, lightweight structures that may be formed from a variety of materials. The use of nonmetallic lattice members, rather than steel, avoids detrimentally affecting the signals received and transmitted from the individual antennas. The slots milled in each pipe shield the antenna in a slender profile while enhancing the performance of the wave guides. The pipes and waves guides are designed to get wave and signal fronts to each slot at approximately the same time. The slots also may be custom designed for any application, depending upon the frequency and pattern direction of the wave guides.

While the invention has been shown or described in only some of its forms, it should be apparent to those skilled in the art that it is not so limited, but is susceptible to various changes without departing from the scope of the invention.

I claim:

1. An antenna support for mounting to an existing communications tower, comprising:

a truss adapted to be mounted on top of the existing communications tower such that an entire weight of the antenna support is carried by the existing communications tower;

a plurality of legs which are parallel to one another, the legs extending upward from the truss;

a plurality of nonmetallic lattice members which interconnect the legs to each other; and

a set of wave guides mounted to at least one of the legs to form an antenna.

2. The antenna support of claim **1** wherein:

said at least one of the legs is cylindrical;

wherein the set of wave guides is mounted inside said at least one of the legs; and wherein the antenna support further comprises:

a plurality of slots in said at least one of the legs, the set of wave guides being aligned with the slots for enhancing the performance of said wave guides.

3. The antenna support of claim **1** wherein each of the legs is formed from a nonmetallic composite material.

4. The antenna support of claim **1** wherein each of the legs is formed from steel.

5. The antenna support of claim **4** wherein the wave guides are contained with a housing mounted to said at least one of the legs.

6. The antenna support of claim **5** wherein the housing is a tubular member mounted parallel to said at least one of the legs.

7. The antenna support of claim **1** wherein the lattice members comprise:

a plurality of horizontal, rigid braces mounted between and perpendicular to the legs; and

a plurality of diagonal composite fiber wires connected between upper and lower adjacent ones of the braces.

8. The antenna support of claim **7** wherein the diagonal composite fiber wires cross each other in an x-pattern.

9. An antenna support for mounting to an existing communications tower, comprising:

a truss adapted to be mounted on top of the existing communications tower such that an entire weight of the antenna support is carried by the existing communications tower;

a plurality of steel legs which are parallel to one another, the legs extending upward from the truss;

a plurality of nonmetallic lattice members which interconnect the legs to each other;

a tubular housing mounted parallel to one of the legs; and

a set of wave guides mounted inside the housing to form an antenna.

10. The antenna support of claim **9** wherein the lattice members comprise:

a plurality of horizontal, rigid braces mounted between and perpendicular to the legs; and

a plurality of diagonal composite fiber wires connected between upper and lower adjacent ones of the braces.

11. The antenna support of claim **10** wherein the diagonal composite fiber wires cross each other in an x-pattern.

12. An antenna support for mounting to an existing communications tower, comprising:

a metal truss adapted to be mounted on top of the existing communications tower such that an entire weight of the antenna support is carried by the existing communications tower;

a plurality of tubular legs which are parallel to one another and extend upward from the metal truss;

a plurality of nonmetallic lattice members which interconnect the legs to each other;

a set of wave guides mounted inside at least one of the legs to form an antenna; and

a plurality of slots in said at least one of the legs, the set of wave guides being aligned with the slots for enhancing the performance of said wave guides.

13. The antenna support of claim **12** wherein each of the legs is formed from a nonmetallic composite material.

14. The antenna support of claim **12** wherein the lattice members comprise:

a plurality of horizontal, rigid braces mounted between and perpendicular to the legs; and

a plurality of diagonal composite fiber wires connected between upper and lower adjacent ones of the braces.

15. The antenna support of claim **14** wherein the diagonal composite fiber wires cross each other in an x-pattern.

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